

**The History and Development of Mathematics Examinations
in New South Wales at the end of Secondary Schooling
between 1788 and 2010**

Stephen A Curtis

**Thesis submitted in fulfillment of the requirement for the degree
of**

Doctor of Philosophy

May, 2011

**Faculty of Arts and Social Sciences
University of Technology, Sydney**

Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Stephen A Curtis

Acknowledgements

Anyone who has been either directly or indirectly involved in a doctoral study will recognize that it is an enormous undertaking and it cannot be successfully completed without the support and understanding of academic supervisors, work associates, various support staff, family and friends.

In the first instance I would like to thank Professor Jim Athanasou for encouraging me to begin my doctoral studies and for guiding me through the first few years of confusion and doubt until we finally settled on the research topic. I would also like to thank Professor Athanasou for his valuable advice in reading an early draft of my completed thesis.

Following the departure of Professor Jim Athanasou from the University of Technology, Sydney I was fortunate that Doctor Anne Prescott had agreed to be my supervisor. She had the unenviable task of reading everything I have written over and over again. Her sound understanding and knowledge of the examination system helped me enormously in working through the data. Without her valuable input and support this doctoral research would not have been possible. My further appreciation to Doctor Matthew McDonald for his help in editing and proof reading my thesis prior to its submission.

I would also like to thank the assistance and input of the academic and library staff at the University of Technology, Sydney who helped me along the way. In particular I would like to thank Ms Denise Lamond the librarian from the Board of Studies NSW who helped me to locate the hundreds of examination papers, examiners' comments and curriculum documentation. A special thanks to Professor Menachem Hofnung from the Hebrew University in Jerusalem, who took time out during his recent sabbatical in Sydney to discuss this paper with me.

A final acknowledgement is to my family and friends. Ways in which I shall probably be the last to appreciate, my wife Dorothy and my children Vanessa and Jeffrey, have all contributed intellectual ingredients to my work by encouraging devotion to it. I greatly appreciate and thank them all for their love, support and understanding.

Dedication

This thesis is dedicated to my parents Elizabeth and Emery Curtis.

They believed that education and knowledge can never be
taken from anyone and made enormous sacrifices
so their children would have every
opportunity to study.

Table of Contents

Declaration	II
Acknowledgements	III
Dedication	IV
Table of Content	V
List of Tables and Figures	XII
Abstract of Thesis	XXIII
Chapter 1 Introduction	1
1.1 Rationale for the research	1
1.2 Purpose of this study	2
Chapter 2 Literature Review	5
2.1 Importance of mathematics	6
2.2 Changing society	8
2.3 Curriculum changes	10
2.4 Examination process	17
2.4.1 Matriculation examination	19
2.4.2 Junior and Senior public examinations	20
2.4.3 Leaving Certificate	20
2.4.4 Higher School Certificate	21
2.5 Analysis used to study mathematics examinations	22
2.5.1 Cognitive competencies	23
2.5.2 Examining the examinations	24
2.5.3 Using instructions to test critical thinking strategies	27
2.5.4 TIMSS	31
2.6 Review	34

Chapter 3	Research Methodology	37
3.1	Theoretical concepts	37
3.2	Historical research	40
3.3	Description of content analysis	41
3.3.1	Validity	42
3.3.2	Reliability	43
3.4	Methods of content analysis	45
3.4.1	Identifying changes in the examination papers	45
3.4.2	Heuristic investigative process	48
3.4.3	Data collection	51
3.4.4	Data evaluation	54
3.4.4.1	External criticism	54
3.4.4.2	Internal criticism	54
3.5	Application of content analysis	56
3.5.1	Data recording	60
3.5.2	Data representation	61
3.5.3	Societal influences on the examination process	62
3.6	Review	62
Chapter 4	New South Wales in the Early Days, 1788-1850	64
4.1	Background	64
4.2	Curriculum changes	71
4.3	Examination process	72
4.4	Review	74
Chapter 5	Start of Formal Examinations, 1850 – 1904	75
5.1	Background	75
5.2	Curriculum changes	80
5.3	Examination process	83
5.3.1	Description of examination papers	84
5.3.1.1	Junior and Senior public examinations	84
5.3.1.2	Matriculation examination	84

5.4 Results	85
5.4.1 Higher level, Senior Public and Matriculation honours	86
5.4.1.1 Content	87
5.4.1.1.1 Arithmetic by topics	87
5.4.1.1.2 Arithmetic at ten year intervals	87
5.4.1.1.3 Algebra by topics	88
5.4.1.1.4 Algebra at ten year intervals	89
5.4.1.1.5 Geometry by topics	90
5.4.1.1.6 Geometry at ten year intervals	91
5.4.1.1.7 Trigonometry by topics	91
5.4.1.1.8 Trigonometry at ten year intervals	92
5.4.1.2 Instructions	93
5.4.1.2.1 Higher level	93
5.4.1.2.2 Higher level at ten year intervals	94
5.4.2 Lower level, junior public and matriculation	95
5.4.2.1 Content	95
5.4.2.1.1 Arithmetic by topics	95
5.4.2.1.2 Arithmetic at ten year intervals	95
5.4.2.1.3 Algebra by topics	96
5.4.2.1.4 Algebra at ten year intervals	97
5.4.2.1.5 Geometry by topics	97
5.4.2.1.6 Geometry at ten year intervals	98
5.4.2.2 Instructions	98
5.4.2.2.1 Lower level	99
5.4.2.2.2 Lower level at ten year intervals	100
5.4.3 Matriculation versus Public examinations	100
5.5 Review	101
 Chapter 6 Calculus a new beginning, 1904 – 1939	 105
6.1 Background	105
6.1.1 Changing society	111
6.1.1.1 Oldest generation	111

6.1.1.2 Lucky generation/Builders	111
6.2 Curriculum changes	112
6.3 Examination process	113
6.4 Description of examination papers	117
6.4.1 Junior public	117
6.4.2 Senior public	118
6.4.3 Leaving Certificate	118
6.4.4 Matriculation	119
6.5 Results	120
6.5.1 Leaving Certificate Honours	121
6.5.1.1 Content	121
6.5.1.2 Instructions	123
6.5.2 Higher standard	124
6.5.2.1 Content	125
6.5.2.2 Instructions	126
6.5.3 Lower standard	128
6.5.3.1 Content	128
6.5.3.2 Instructions	130
6.6 Review	131
Chapter 7 Changing world, 1939 – 1962	134
7.1 Background	134
7.1.1 Changing society	138
7.1.1.1 Baby boomers	138
7.2 Curriculum changes	139
7.3 Examination process	141
7.4 Description of examination papers	141
7.5 Results	143
7.5.1 Examinations with calculus	143
7.5.1.1 First Level	143

7.5.1.1.1 Content	143
7.5.1.1.2 Instructions	144
7.5.1.2 Second level	144
7.5.1.2.1 Content	145
7.5.1.2.2 Instructions	145
7.5.1.3 Third level	146
7.5.1.3.1 Content	146
7.5.1.3.2 Instructions	149
7.5.2 Examinations without calculus	151
7.5.2.1 Higher level	151
7.5.2.1.1 Content	151
7.5.2.1.2 Instructions	153
7.5.2.2 Lower level	154
7.4.2.1.1 Content	155
7.4.2.1.2 Instructions	155
7.6 Review	156
Chapter 8 The Wyndham Legacy, 1962 – 2008	159
8.1 Background	159
8.1.1 Changing society	164
8.1.1.1 Generation X (1965 – 1979)	164
8.1.1.2 Generation Y (1980 – 1994)	166
8.1.1.3 Generation Z (1995 – 2009)	166
8.2 Curriculum changes	167
8.3 Examination process	173
8.3.1 Higher School Certificate	174
8.3.2 Matriculation	175
8.4 Description of Examination Papers	176
8.4.1 Examinations in the 1960s	176
8.4.2 Transition to the Higher School Certificate	177
8.4.3 Matriculation examination	177

8.5 Results	178
8.5.1 Explanation of examination papers	179
8.5.2 Examinations with calculus	179
8.5.2.1 First level	179
8.5.2.1.1 Content	179
8.5.2.1.2 Instructions	182
8.5.2.2 Second level	184
8.5.2.2.1 Content	184
8.5.2.2.2 Instructions	186
8.5.2.3 Third level	189
8.5.2.3.1 Content	189
8.5.2.3.2 Instructions	191
8.5.3 Examinations without calculus	193
8.5.3.1 Content	193
8.5.3.2 Instructions	196
8.5.3.3 Comparing Mathematics in Society (MIS) with Mathematics in Practice (MIP)	198
8.6 Review	199
 Chapter 9 The Big Picture, 1881 – 2008	 203
9.1 Cognitive competency	203
9.1.1 Entry level calculus, 1916 and 2008	203
9.1.2 Non-calculus, 1881 and 2008	205
9.1.3 Cognitive results	206
9.2 Longitudinal overview	207
9.2.1 Entry level calculus, 1916 and 2008	207
9.2.1.1 Content	208
9.2.1.2 Instructions	211
9.2.2 Non-calculus, 1881 and 2008	214
9.2.2.1 Content	214
9.2.2.2 Instructions	218
9.2.3 Longitudinal results	220

9.3 Statistical overview	223
9.3.1 Statistical results	224
9.4 Review	224
 Chapter 10 Conclusions	 226
10.1 Introduction	226
10.2 Answers to research questions	227
10.2.1 Research Question 1	227
10.2.1.1 What has changed?	227
10.2.1.2 What has stayed the same?	229
10.2.2 Research Question 2	230
10.2.2.1 Changing society	230
10.2.2.2 Key people and reports	231
10.2.3 Research Question 3	234
10.3 Difficulty of examinations	234
10.4 Suggestions for future research	235
 References	 239

	Tables	Page
Table 2.1	Australia's generation classification	9
Table 2.2	Learning styles (AAMT, 2009)	10
Table 2.3	BOS glossary grouped by knowledge, skill and understanding (BOSHSC Update Newsletter 2, 2002)	28
Table 2.4	Adaptation of Bloom's critical thinking strategies	31
Table 2.5	Categories considered for analysis (Cochrane, 1999)	32
Table 2.6	Cognitive domain criteria (TIMSS, 2009)	33
Table 3.1	Examination papers used for analysis.	49
Table 3.2	References	52
Table 3.3	Content of topics for a sample examination paper	60
Table 5.1	Topics examined for Junior Public and Matriculation examinations	85
Table 5.2	Topics examined for Senior Public and Matriculation Honours examinations	86
Table 6.1	Pathway to university before the Leaving Certificate	114
Table 6.2	Pathway to university after the Leaving Certificate	116
Table 6.3	List of courses from 1901 – 1942	117
Table 7.1	Summary of mathematics examination papers 1932 – 1962	142
Table 8.1	Summary of mathematics examination papers 1962 – 2008	176
Table 8.2	Comparison between the Leaving Certificate and the HSC	177
Table 8.3	Matriculation comparison table	177
Table 8.4	Description of all HSC examinations	178

Figures

Chapter 2

Figure 2.1	Examination topics to be considered	24
Figure 2.2	4th Grade selected results for Knowing, Applying & Reasoning	33
Figure 2.3	8th Grade selected results for Knowing, Applying & Reasoning	33

Chapter 3

Figure 3.1	Example of tally of instructions	43
------------	----------------------------------	----

Chapter 5

Higher level - Senior Public and Matriculation Honours

Arithmetic

Figure 5.1	Content: Calculation	87
Figure 5.2	Content: Mensuration	87
Figure 5.3	Content: Finance	87

	Page
Figure 5.4 Content in 1881	88
Figure 5.5 Content in 1891	88
Figure 5.6 Content in 1901	88
<i>Algebra</i>	
Figure 5.7 Content: Simplify	88
Figure 5.8 Content: Equations	88
Figure 5.9 Content: Proof	89
Figure 5.10 Content: Factorize	89
Figure 5.11 Content: Indices and Surds	89
Figure 5.12 Content: Series	89
Figure 5.13 Content: Logarithms	89
Figure 5.14 Content: Binomial theorem	89
Figure 5.15 Content in 1881	89
Figure 5.16 Content in 1891	89
Figure 5.17 Content in 1901	90
<i>Geometry</i>	
Figure 5.18 Content: Definitions	90
Figure 5.19 Content: Triangle proof	90
Figure 5.20 Content: Circle proof	90
Figure 5.21 Content: Polygon proof	90
Figure 5.22 Content in 1881	91
Figure 5.23 Content in 1891	91
Figure 5.24 Content in 1901	91
<i>Trigonometry</i>	
Figure 5.25 Content: Proof	92
Figure 5.26 Content: Sine & Cosine rule and Functions	92
Figure 5.27 Content: Compound angles	92
Figure 5.28 Content in 1881	92
Figure 5.29 Content in 1891	92
Figure 5.30 Content in 1901	92
<i>Instructions</i>	
Figure 5.31 Instructions using Simplify	93
Figure 5.32 Instructions using What is	93
Figure 5.33 Instructions using Solve	93
Figure 5.34 Instructions using Prove	93
Figure 5.35 Instructions using Define	93
Figure 5.36 Instructions using Find	93
Figure 5.37 Instructions using How	94
Figure 5.38 Instructions using Calculate	94
Figure 5.39 Instructions using Show	94
Figure 5.40 Instructions used in 1881	94
Figure 5.41 Instructions used in 1891	94
Figure 5.42 Instructions used in 1901	94
Lower level - Junior Public and Matriculation	95
<i>Arithmetic</i>	95
Figure 5.43 Content: Calculation	95

		Page
Figure 5.44	Content: Mensuration	95
Figure 5.45	Content: Finance	95
Figure 5.46	Content in 1881	95
Figure 5.47	Content in 1891	95
Figure 5.48	Content in 1901	96
<i>Algebra</i>		
Figure 5.49	Content: Simplify	96
Figure 5.50	Content: Equations	96
Figure 5.51	Content: Proof	96
Figure 5.52	Content: Factorize	96
Figure 5.53	Content in 1881	99
Figure 5.54	Content in 1891	99
Figure 5.55	Content in 1901	97
<i>Geometry</i>		
Figure 5.56	Content: Definitions	97
Figure 5.57	Content: Triangle proof	97
Figure 5.58	Content: Circle proof	97
Figure 5.59	Content: Polygon proof	98
Figure 5.60	Content in 1881	98
Figure 5.61	Content in 1891	98
Figure 5.62	Content in 1901	98
<i>Instructions</i>		
Figure 5.63	Instructions using Simplify	99
Figure 5.64	Instructions using What is	99
Figure 5.65	Instructions using Solve	99
Figure 5.66	Instructions using Prove	99
Figure 5.67	Instructions using Define	99
Figure 5.68	Instructions using Find	99
Figure 5.69	Instructions using How	99
Figure 5.70	Instructions using Calculate	99
Figure 5.71	Instructions used in 1881	100
Figure 5.72	Instructions used in 1891	100
Figure 5.73	Instructions used in 1901	100
<i>Conclusion</i>		
Figure 5.74	Sample examination paper June, 1893	102
 <i>Chapter 6</i>		
Leaving Certificate Honours (with calculus)		
Figure 6.1	Content: Harder algebra	122
Figure 6.2	Content: Series	122
Figure 6.3	Content: Geometry	122
Figure 6.4	Content: Trigonometry	122
Figure 6.5	Content: Calculus	122
Figure 6.6	Content: Binomial theorem	122
Figure 6.7	Content in 1916	122
Figure 6.8	Content in 1922	122
Figure 6.9	Content in 1932	123

		Page
Figure 6.10	Content in 1942	123
Figure 6.11	Instructions using Find	123
Figure 6.12	Instructions using Show	123
Figure 6.13	Instructions using Prove	123
Figure 6.14	Instructions using What is	123
Figure 6.15	Instructions using Write down	124
Figure 6.16	Instructions using Discuss	124
Figure 6.17	Instructions used in 1916	124
Figure 6.18	Instructions used in 1922	124
Figure 6.19	Instructions used in 1932	124
Figure 6.20	Instructions used in 1942	124

Higher standard (non-calculus)

Figure 6.21	Content: Arithmetic	125
Figure 6.22	Content: Algebra	125
Figure 6.23	Content: Geometry	125
Figure 6.24	Content: Trigonometry	125
Figure 6.25	Content: Series	125
Figure 6.26	Content: Binomial theorem	125
Figure 6.27	Content in 1901	126
Figure 6.28	Content in 1911	126
Figure 6.29	Content in 1922	126
Figure 6.30	Content in 1932	126
Figure 6.31	Content in 1942	126
Figure 6.32	Instructions using Solve	127
Figure 6.33	Instructions using Prove	127
Figure 6.34	Instructions using Find	127
Figure 6.35	Instructions using Show	127
Figure 6.36	Instructions used in 1901	127
Figure 6.37	Instructions used in 1911	127
Figure 6.38	Instructions used in 1922	127
Figure 6.39	Instructions used in 1932	127
Figure 6.40	Instructions used in 1942	128

Lower standard (non-calculus)

Figure 6.41	Content: Arithmetic/Algebra	128
Figure 6.42	Content: Equations	128
Figure 6.43	Content: Harder algebra	128
Figure 6.44	Content: Geometry	128
Figure 6.45	Content: Trigonometry	129
Figure 6.46	Content in 1901	129
Figure 6.47	Content in 1911	129
Figure 6.48	Content in 1922	129
Figure 6.49	Content in 1932	129
Figure 6.50	Content in 1942	129
Figure 6.51	Instructions using Solve	130
Figure 6.52	Instructions using Prove	130

		Page
Figure 6.53	Instructions using Find	130
Figure 6.54	Instructions using Show	130
Figure 6.55	Instructions used in 1901	131
Figure 6.56	Instructions used in 1911	131
Figure 6.57	Instructions used in 1922	131
Figure 6.58	Instructions used in 1932	131
Figure 6.59	Instructions used in 1942	131

Chapter 7

First level

Figure 7.1	Content in 1962	144
Figure 7.2	Instructions used in 1962	144

Second level

Figure 7.3	Content in 1952	145
Figure 7.4	Content in 1962	145
Figure 7.5	Instructions used in 1952	146
Figure 7.6	Instructions used in 1962	146

Third level

Figure 7.7	Second level content in 1962	147
Figure 7.8	Third level content in 1962	147
Figure 7.9	Content: Algebra	148
Figure 7.10	Content: Series	148
Figure 7.11	Content: Logs/Exp	148
Figure 7.12	Content: Calculus	148
Figure 7.13	Content: Geometry	148
Figure 7.14	Content: Trigonometry	148
Figure 7.15	Content: Binomial theorem	148
Figure 7.16	Content in 1932	149
Figure 7.17	Content in 1942	149
Figure 7.18	Content in 1952	149
Figure 7.19	Content in 1962	149
Figure 7.20	Instruction using What is	150
Figure 7.21	Instruction using Solve	150
Figure 7.22	Instruction using Prove	150
Figure 7.23	Instruction using Find	150
Figure 7.24	Instruction using Show	150
Figure 7.25	Instruction using State	150
Figure 7.26	Instructions used in 1932	150
Figure 7.27	Instructions used in 1942	150
Figure 7.28	Instructions used in 1952	151
Figure 7.29	Instructions used in 1962	151

Higher level

Figure 7.30	Content: Algebra	152
Figure 7.31	Content: Geometry	152
Figure 7.32	Content: Trigonometry	152
Figure 7.33	Content in 1932	152
Figure 7.34	Content in 1942	152

		Page
Figure 7.35	Content in 1952	152
Figure 7.36	Content in 1962	152
Figure 7.37	Instructions using Find	153
Figure 7.38	Instructions using What	153
Figure 7.39	Instructions using Show	153
Figure 7.40	Instructions using Solve	153
Figure 7.41	Instructions using Calculate	153
Figure 7.42	Instructions using Prove	153
Figure 7.43	Instructions using Write	154
Figure 7.44	Instructions used in 1932	154
Figure 7.45	Instructions used in 1942	154
Figure 7.46	Instructions used in 1952	154
Figure 7.47	Instructions used in 1962	154
Lower level		
Figure 7.48	Content by examinations	155
Figure 7.49	Examinations by content	155
Figure 7.50	Instructions by examinations	156
Figure 7.51	Examination by instructions	156
 Chapter 8		
First level		
Figure 8.1	Content: Algebra	180
Figure 8.2	Content: Calculus	180
Figure 8.3	Content: Geometry	180
Figure 8.4	Content: Trigonometry	180
Figure 8.5	Content: Probability	181
Figure 8.6	Content: Complex numbers	181
Figure 8.7	Content: Matrices	181
Figure 8.8	Content: Induction	181
Figure 8.9	Content: Conics	181
Figure 8.10	Diagrams, graphs and tables	181
Figure 8.11	Content in 1962	181
Figure 8.12	Content in 1973	181
Figure 8.13	Content in 1982	181
Figure 8.14	Content in 1992	181
Figure 8.15	Content in 2002	182
Figure 8.16	Content in 2008	182
Figure 8.17	Instructions using Find	182
Figure 8.18	Instructions using Prove	182
Figure 8.19	Instructions using Show	182
Figure 8.20	Instructions using State	182
Figure 8.21	Instructions using Deduce	183
Figure 8.22	Instructions using What is	183
Figure 8.23	Instructions using Write down	183
Figure 8.24	Instructions using Sketch	183
Figure 8.24a	Variety of Instructions	183
Figure 8.25	Instructions used in 1962	183

	Page
Figure 8.26 Instructions used in 1973	183
Figure 8.27 Instructions used in 1982	183
Figure 8.28 Instructions used in 1992	183
Figure 8.29 Instructions used in 2002	184
Figure 8.30 Instructions used in 2008	184
Second level	
Figure 8.31 Content: Algebra	185
Figure 8.32 Content: Calculus	185
Figure 8.33 Content: Geometry	185
Figure 8.34 Content: Trigonometry	185
Figure 8.35 Content: Probability	185
Figure 8.36 Content: Binomial theorem	185
Figure 8.37 Content: Series	185
Figure 8.38 Content: Induction	185
Figure 8.39 Content: Projectile motion	185
Figure 8.40 Content: S.H.M	185
Figure 8.41 Total of all calculus	186
Figure 8.42 Diagrams, graphs and tables	186
Figure 8.43 Content in 1962	186
Figure 8.44 Content in 1973	186
Figure 8.45 Content in 1982	186
Figure 8.46 Content in 1992	186
Figure 8.47 Content in 2002	186
Figure 8.48 Content in 2008	186
Figure 8.49 Instructions using Find	187
Figure 8.50 Instructions using Show	187
Figure 8.51 Instructions using Calculate	187
Figure 8.52 Instructions using Evaluate	187
Figure 8.53 Instructions using What is	187
Figure 8.54 Instructions using Write down	187
Figure 8.55 Instructions using Sketch	188
Figure 8.55a Variety of instructions	188
Figure 8.56 Instructions used in 1962	188
Figure 8.57 Instructions used in 1973	188
Figure 8.58 Instructions used in 1982	188
Figure 8.59 Instructions used in 1992	188
Figure 8.60 Instructions used in 2002	188
Figure 8.61 Instructions used in 2008	188
Third level	
Figure 8.62 Content: Algebra	189
Figure 8.63 Content: Calculus	189
Figure 8.64 Content: Geometry	190
Figure 8.65 Content: Trigonometry	190
Figure 8.66 Content: Probability	190
Figure 8.67 Content: Series and Finance	190
Figure 8.68 Content of all calculus	190
Figure 8.69 Diagrams, graphs and tables	190

		Page
Figure 8.70	Content in 1962	190
Figure 8.71	Content in 1973	191
Figure 8.72	Content in 1982	191
Figure 8.73	Content in 1992	191
Figure 8.74	Content in 2002	191
Figure 8.75	Content in 2008	191
Figure 8.76	Instructions using Find	191
Figure 8.77	Instructions using Shaw	191
Figure 8.78	Instructions using Calculate	192
Figure 8.79	Instructions using What is	192
Figure 8.80	Instructions using Write down	192
Figure 8.81	Instructions using Sketch	192
Figure 8.82	Variety of instructions	192
Figure 8.83	Instructions used in 1962	192
Figure 8.84	Instructions used in 1973	192
Figure 8.85	Instructions used in 1982	193
Figure 8.86	Instructions used in 1992	193
Figure 8.87	Instructions used in 2002	193
Figure 8.88	Instructions used in 2008	193
Non-calculus		
Figure 8.89	Content: Arithmetic and Algebra	194
Figure 8.90	Content: Measurement	194
Figure 8.91	Content: Geometry	194
Figure 8.92	Content: Trigonometry	194
Figure 8.93	Content: Financial mathematics	194
Figure 8.94	Content: Statistics	194
Figure 8.95	Content: Probability	195
Figure 8.96	Content of graphs	195
Figure 8.97	Diagrams, graphs and tables	195
Figure 8.98	Content in 1962	195
Figure 8.99	Content in 1973	195
Figure 8.100	Content in 1982	195
Figure 8.101	Content in 1992	195
Figure 8.102	Content in 2002	196
Figure 8.103	Content in 2008	196
Figure 8.104	Instructions using Find	196
Figure 8.105	Instructions using What is	196
Figure 8.106	Instructions using How	196
Figure 8.107	Instructions using Which	196
Figure 8.108	Instructions using Calculate	197
Figure 8.109	Instructions using Sketch	197
Figure 8.110	Instructions using Write down	197
Figure 8.110a	Variety of Instructions	197
Figure 8.111	Instructions used in 1962	197
Figure 8.112	Instructions used in 1973	197
Figure 8.113	Instructions used in 1982	197
Figure 8.114	Instructions used in 1992	197

	Page
Figure 8.115 Instructions used in 2002	198
Figure 8.116 Instructions used in 2008	198
Figure 8.117 Topics for MIS and MIP	198
Figure 8.118 Instructions for MIS and MIP	198
Figure 8.119 Diagrams for MIS and MIP	199
Figure 8.120 Variety of Instructions	199

Chapter 9

Entry level calculus

Figure 9.1 Instructions for 1916 (blue) and 2008 (red)	205
Figure 9.2 Totals for What is/Find and Prove/Show	205

Non-calculus

Figure 9.3 Instructions for 1916 (blue) and 2008 (red)	206
Figure 9.4 Totals for What is/Find and Prove/Show	206

Entry Level calculus

Figure 9.5 Content: Algebra	208
Figure 9.6 Content: Calculus	208
Figure 9.7 Content: Geometry	209
Figure 9.8 Content: Trigonometry	209
Figure 9.9 Content: Series	209
Figure 9.10 Content: Finance	209
Figure 9.11 Content: Logarithms	209
Figure 9.12 Content: Binomial theorem	209
Figure 9.13 Content: Probability	209
Figure 9.14 Diagrams, graphs and tables	209
Figure 9.15 Content in 1916	210
Figure 9.16 Content in 1922	210
Figure 9.17 Content in 1932	210
Figure 9.18 Content in 1942	210
Figure 9.19 Content in 1952	210
Figure 9.20 Content in 1962	210
Figure 9.21 Content in 1973	210
Figure 9.22 Content in 1982	210
Figure 9.23 Content in 1992	211
Figure 9.24 Content in 2002	211
Figure 9.25 Content in 2008	211
Figure 9.26 Overview of Content 1916 – 2008	211
Figure 9.27 Instructions using Find	211
Figure 9.28 Instructions using What is	211
Figure 9.29 Instructions using Prove	212
Figure 9.30 Instructions using Show	212
Figure 9.31 Instructions using Calculate	212
Figure 9.32 Instructions using Solve	212
Figure 9.33 Instructions using Write down	212
Figure 9.34 Instructions using Sketch	212
Figure 9.35 Instructions used in 1916	213
Figure 9.36 Instructions used in 1922	213

		Page
Figure 9.37	Instructions used in 1932	213
Figure 9.38	Instructions used in 1942	213
Figure 9.39	Instructions used in 1952	213
Figure 9.40	Instructions used in 1962	213
Figure 9.41	Instructions used in 1973	213
Figure 9.42	Instructions used in 1982	213
Figure 9.43	Instructions used in 1992	213
Figure 9.44	Instructions used in 2002	213
Figure 9.45	Instructions used in 2008	214
Figure 9.46	Overview of Instructions 1916 – 2008	214
Non-calculus		
Figure 9.47	Content: Arithmetic & Algebra	215
Figure 9.48	Content: Finance	215
Figure 9.49	Content: Geometry	215
Figure 9.50	Content: Trigonometry	215
Figure 9.51	Content: Series	215
Figure 9.52	Content: Logarithms	215
Figure 9.53	Content: Statistics	215
Figure 9.54	Content: Probability	214
Figure 9.55	Diagrams, graphs and tables	215
Figure 9.56	Content in 1881	215
Figure 9.57	Content in 1891	216
Figure 9.58	Content in 1901	216
Figure 9.59	Content in 1911	216
Figure 9.60	Content in 1922	216
Figure 9.61	Content in 1932	216
Figure 9.62	Content in 1942	217
Figure 9.63	Content in 1952	217
Figure 9.64	Content in 1962	217
Figure 9.65	Content in 1973	217
Figure 9.66	Content in 1982	217
Figure 9.67	Content in 1992	217
Figure 9.68	Content in 2002	217
Figure 9.69	Content in 2008	217
Figure 9.70	Overview of Content 1881 – 2008	217
Figure 9.71	Instructions using Find	218
Figure 9.72	Instructions using What is	218
Figure 9.73	Instructions using Prove	218
Figure 9.74	Instructions using Show	218
Figure 9.75	Instructions using Calculate	218
Figure 9.76	Instructions using How	218
Figure 9.77	Instructions used in 1881	219
Figure 9.78	Instructions used in 1891	219
Figure 9.79	Instructions used in 1901	219
Figure 9.80	Instructions used in 1911	219
Figure 9.81	Instructions used in 1922	219
Figure 9.82	Instructions used in 1932	219

	Page
Figure 9.83 Instructions used in 1942	219
Figure 9.84 Instructions used in 1952	219
Figure 9.85 Instructions used in 1962	220
Figure 9.86 Instructions used in 1973	220
Figure 9.87 Instructions used in 1982	220
Figure 9.88 Instructions used in 1992	220
Figure 9.89 Instructions used in 2002	220
Figure 9.90 Instructions used in 2008	220
Figure 9.91 Overview of Instructions 1881 – 2008	220
Entry level calculus	
Figure 9.92 Content for 1916 and 1952	222
Figure 9.93 Content for 1962 and 2008	222
Figure 9.94 Instructions for 1916 and 1952	222
Figure 9.95 Instructions for 1962 and 2008	222
Non-calculus	
Figure 9.96 Content for 1916 and 1952	222
Figure 9.97 Content for 1962 and 2008	222
Figure 9.98 Instructions for 1916 and 1952	222
Figure 9.99 Instructions for 1962 and 2008	222
Statistical overview	
Figure 9.100 Population growth of NSW	223
Figure 9.101 Percentage of students doing examinations at the end of secondary schooling	223
Figure 9.102 Total number and mathematics students at the end of secondary schooling	224
Figure 9.103 Percentage of mathematics students at the end of secondary schooling	224
Figure 9.104 Total number of mathematics students at the end of secondary schooling	224

ABSTRACT

The History and Development of Mathematics Examinations in New South Wales at the end of Secondary Schooling between 1788 and 2010.

This doctoral dissertation reviews the historical developments of education and mathematics examinations used in New South Wales at the end of secondary schooling from 1788 to 2010. A heuristic investigative process, using a manual application of quantitative content analysis was carried out. Time was used as an independent variable with an application of middle range theory to underpin the theoretical framework for this research.

The hypothesis is that over an extended period of time, it would be reasonable to expect changes to the examination process due to the influence of factors such as historical and political events, curriculum developments, and changes in social values.

The results indicate there was just one significant change identified in the early 1960s. Contrary to expectations, an analysis of the taxonomy of terms has shown that the majority of the questions were skills based and did not test logical thinking and reasoning. Apart from gender and racial equality, the style and the type of questions have not taken into account any other social changes.

In view of the above the concluding chapter will suggest ways forward for educational research.